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The Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School: [Development and Implementation Problems.] Eighth Quarterly Report.

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Technical activity from April 1 through June 30, 1966 involving the development of performance measures used to assess student achievement in relation to instructional objectives are discussed. The major problems encountered in these activities are presented in these sections: General Curriculum Development, Development of Specific Learning Units, Implementation, and Tryout and Revision. These activities are related to one primary goal of the project as given the project proposal which is included, and they are related to content which was derived from an analysis of desired behavior following graduation. The major problems were the specification and communication of the objectives and achieving acceptance of the objectives by the personnel. Other related documents are ED 024 749-ED 024 754 and ED 024 767. (EM)

ED028306

PROJECT ABSTRACT

Title: DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL

Beginning and Ending Dates: 1 September 1968-31 August 1970

OBJECTIVES: The principal goal of the project is to demonstrate increased effectiveness of instruction whose content is explicitly derived from analysis of desired behavior after graduation, and which, in addition, attempts to apply newly developed educational technology to the design, conduct, and evaluation of vocational education. Included in this new technology are methods of defining educational objectives, deriving topical content for courses, preparation of students in prerequisite knowledges and attitudes, individualizing instruction, measuring student achievement, and establishing a system for evaluating program results in terms of outcomes following graduation.

PROCEDURE: The procedure begins with the collection of vocational information for representative jobs in 11 different vocational areas. Analysis will then be made of the performances required for job execution, resulting in descriptions of essential classes of performance which need to be learned. On the basis of this information, a panel of educational and vocational scholars will develop recommended objectives for a vocational curriculum which incorporates the goals of (a) vocational competence; (b) responsible citizenship; and (c) individual self-fulfillment. A curriculum then will be designed in topic form to provide for comprehensiveness, and also for flexibility of coverage, for each of the vocational areas. Guidance programs and prerequisite instruction to prepare junior high students will also be designed. Selection of instructional materials, methods, and aids, and design of materials, when required, will also be undertaken. An important step will be the development of performance measures tied to the objectives of instruction. Methods of instruction will be devised to make possible individualized student progression and selection of alternative programs, and teacher-training materials will be developed to accomplish inservice teacher education of Quincy School Personnel. A plan will be developed for conducting program evaluation not only in terms of end-of-year examinations, but also in terms of continuing follow-up outcomes after graduation.

VT008451

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Project ABLE

THE DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL

Introduction: If today one were asked to characterize, in one word education in the United States, that word would likely be "change." Never has education been of such national concern, with tremendous pressures at all levels to improve the product of our educational processes. Yet while we read on the one hand of the various Federal acts which provide assistance for education, there appears to be a continuing problem with our youth leaving high school prior to graduation. Perhaps of even greater concern, large numbers of our high school graduates enter the labor market with little or no employable skill for today's industrial technology. By some estimates as much as 75% of our secondary school student population will not go on to college; an alarming portion of these non-college bound youngsters will follow a general curriculum in high school which fits them for no specific employment without further formal training.

Paradoxically, industry at this time has large numbers of unfilled jobs at the middle skill levels, and automation, while eliminating some jobs, is also creating jobs at low and upper middle levels. It does not seem too much to ask of education to prepare more of our youth for gainful application of their high school studies. As early as 1963, administration in the school system of Quincy, Massachusetts, took a positive step toward changing the output of its secondary schools. Based on a report from the Massachusetts Department of Education, Division of Vocational Education, that a new vocational-technical school should be established, the School Committee approved plans for the new facility. Planning for a curriculum which departed in a number of aspects from the traditional ideas contained in the usual "trade" school was initiated. The program and architecture of the new vocational-technical school in Quincy was built around the concepts of job families.

Purpose: The development of a program of study for the new school is a joint research project of the Quincy Public Schools and the American Institutes for Research, Pittsburgh, Pennsylvania. It is sponsored by the U. S. Office of Education and is scheduled over a five-year period from its beginning in April 1965. The staff includes twelve full-time research people from the American Institutes for Research and twenty faculty members from the Quincy Public Schools who combine half-time on the project and half-time in teaching. In addition, teachers throughout the system provide a special assistance from time to time. A panel of seven advisors, each of whom is a nationally eminent scholar or educator, met several times each year during the initial stages to provide technical review and guidance to the effort. A local advisory committee composed of Quincy businessmen and civic leaders met monthly during the early stages to consider requirements of the physical plant and plan for graduate placements.

The official title of the program is "Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School." However, the code name "Project ABLE" is being used as descriptive of the basic purpose of the study. That purpose is to provide every student not in the college preparatory program with an opportunity to achieve competence in each of three areas:

1. Skills and knowledges in a chosen field of work;
2. The individual's role as a citizen;
3. Independent pursuit of self-fulfillment and new learning.

The curriculum for the new school is intended to extend from the 10th to the 14th grade, to include post-12th grade instruction in areas like electronics, computer data processing, and the machine tools technology. The specific job families around which both the new school building and the curriculum are being organized are the following:

1. Business Education--Secretarial, Clerical, Bookkeeping, Sales;
2. Computer Data Processing--Equipment Operations, Programming;
3. Electro-Electronics--Electrical Installation, Electronics Repair;
4. Foods Preparation--Food Service, Food Processing;
5. General Piping--Plumbing, Pipefitting, Refrigeration;
6. General Woodworking--Carpentry, Patternmaking, Boatbuilding;
7. Graphic Arts--Printing, Commerical Art, Drafting;
8. Health Occupations--Medical, Dental, and Personal Care;
9. Home Economics--Homemaking, Home Services;
10. Metals and Machines--Sheet Metal, Machine Shop, Foundry;
11. Power Mechanics--Auto Body, Auto Mechanics.

Approach: The principal goal of the project is to demonstrate increased effectiveness of instruction that derives content on explicit analysis of desired behavior after graduation. Rather than taking a total body of knowledge and drawing content from it, curriculum will be defined by what technology and industry need for job success. Subordinate objectives embodied in this plan are the following:

1. Development of educational objectives. The intent here is to identify the behaviors which are desired of the student when he has completed a particular course of instruction. Education has no meaning in the abstract; objectives need to be stated in specific operational terms. While emphasizing the vocational area of educational goals, the goals include the development of individual attitudes toward work, habits of work, and standards of excellence.

2. Derivation of curriculum requirements. Curriculum needs are described in terms of topics within each "subjcect" and placed in an instructional sequence which takes prerequisite knowledges systematically into account. Each learning sequence is in the curriculum because it must be there if the student is to be competent and the justification for its presence can be demonstrated on the basis of relevance to a vocationally oriented educational goal. Project ABLE, by analyzing the requirements of many jobs

within each of the eleven broad vocational areas for common and related skills, will provide education in the skills and knowledges which are common to a variety of occupations. This should minimize the amount of "new" training that might result from job change or as opportunities open up in related areas and provide flexibility needed to accommodate to changes in demands of the technology.

3. Description of needs for prerequisite learning. The elaboration of a new curriculum for the vocational-technical school will also make possible the specification of prerequisite knowledges to be acquired in junior high years of schooling, including the kinds of student preparation which might be gained in industrial arts and other basic areas of instruction. The aim is the development of broad exploratory programs in the junior high grades to prepare students for productive educational and vocational careers.

4. Effecting Changes in Student Viewpoints. The new school, with its newly designed educational offerings, should become attractive to students of a variety of backgrounds and abilities. A most difficult task facing any student and his family is that of choosing realistic life goals and the educational path to that goal. The pressures of our society have been directed toward college attendance while the trade school course has been relegated to second-class status. But we cannot afford to allow even a small fraction of the 75% who will not go to college for one reason or another to leave high school from a "general" course with no particular skill or knowledge to market. The project includes preparation of anorganized program for assessing the student's abilities and interests, and for helping him and his family evaluate these over a wide range of occupations. This involves the in-service training of junior high school guidance counselors and the provision of materials and information for junior high students.

5. Individualizing Instruction. It has been demonstrated repeatedly that individuals differ with respect to a great variety of abilities. The traditional classroom has not made sufficient provision for these individual differences but with increasing frequency, especially at the elementary level, schools are changing to ungraded study programs. Project ABLE incorporates the concepts of individualized instruction by providing a framework which will allow for maximum flexibility of student progression through a course. Learning is a process guided by the teacher rather than forcing facts into students. A student's achievement is the standard of his learning progress and at the same time a primary source of his motivation. The student is given a set of objectives which tell him all the things he is expected to be able to do after completing an assignment. Individual tutoring, small group discussions among students at a similar stage of progress, demonstrations, and possible seminars are decided upon by the teacher and scheduled as needed. The key feature, however, is that students do the learning largely on their own and student-teacher interactions are not restricted to lecture classes. When the student completes an assignment and feels he is ready to go on, he informs the teacher who administers the appropriate achievement test, scores the test immediately, and if the student has succeeded, makes another assignment.

6. Student Evaluation. Appropriately derived topic objectives lead directly to measures of student performance. It is desired here that all "units" of instruction have performance measures which are available to the student, to instructors, and to guidance counselors. These proficiency tests are an essential and integral part of individualized instruction, and they contribute to making the student evaluation file a clear history of learning achievement. Emphasis in this testing is on attainment of goals, rather than upon differentiation of students into "good" or "bad," and to provide directions for future effort on the part of the student.

7. Program Evaluation. A comprehensive program of evaluation includes objective measures of immediate outcomes, as well as the foundation of techniques for the later collection of follow-up data on educational outcomes after graduation. Student evaluations yield many of the basic data for program evaluation; this requires systematic recording and storing of indicators of student experience and performance. A second feature is establishment of techniques for following up the student at periodic intervals to collect information on employment, job success, and career progression at intervals after graduation. Systematic information of this sort will constitute the basis for program evaluation in terms of its long-range effects.

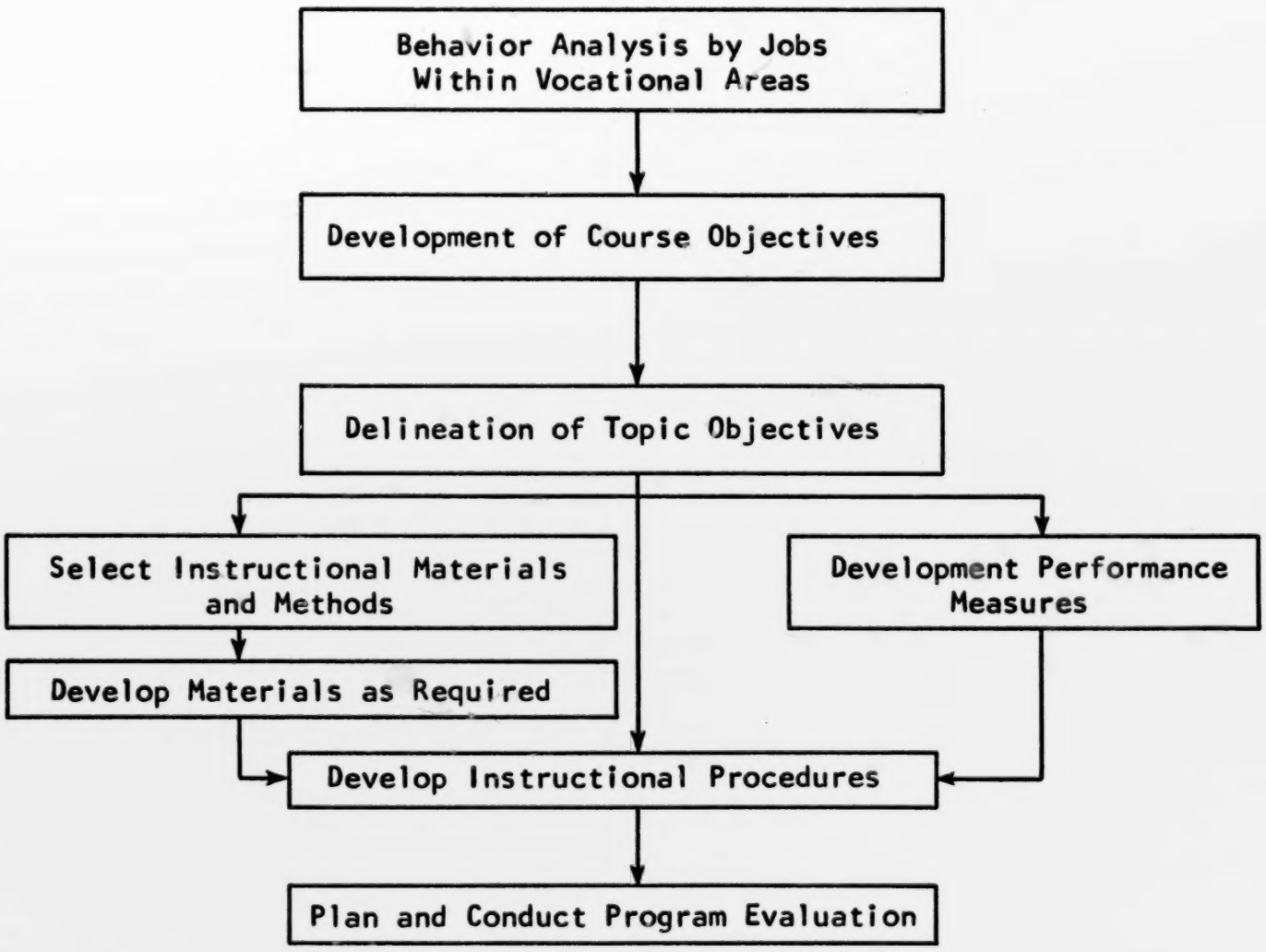
Behavior Analysis by Jobs Within Vocational Areas
Development of Course Objectives
Delineation of Topic Objectives
Select Instructional Materials and Methods
Development Performance Measures
Develop Materials as Required
Develop Instructional Procedures
Plan and Conduct Program Evaluation

Figure 1. Overview of Steps in Curriculum Development and Evaluation

Some Expected Outcomes: Although the immediate goal has been curriculum development, there are features being incorporated that deserve separate identification. The students of immediate concern in the project are those who are not college-bound. Provision has been made, however, for those who may change their educational path. The curriculum provides the courses needed to meet, in part, the college entrance requirements; at the same time the curriculum is oriented toward the general vocational education that all students should have to meet the demands of everyday living in an increasingly complex technical society. At the junior high school level is a vocational guidance program which helps the student make educational and vocational decisions and provides information about the world of work and its occupations. This provides each student with materials he needs to make a sequence of decisions narrowing from a choice of educational paths most compatible with his abilities and interests through selection of a vocational area to a specific group of jobs within the area. At the high school level, a sequence in Social Studies deals with the economics and sociology of industry and the citizen in modern society in relation to family and political institutions. For Mathematics, the courses are aimed at competence and speed in basic operations, progressing to measurement, graphing, and descriptive geometry, and culminating in algebraic equations and trigonometry. English has as its goal to provide instruction in reading, oral and written communication, beginning at basic levels of competence and progressing to the comprehension of technical reports, and providing appreciation of human values in literature, beginning at points of interest appropriate to the least "literate" student. A Science course provides the theoretical background for the vocational areas. Elective courses will be oriented toward acquaintance with activities of a self-fullfillment leisure-time nature.

A second benefit which might be expected to accrue follows from the idea of general vocational competence. A vocational area-behavioral analysis approach to specification of course and topic objectives stated in terms of performances required for job execution distinguishes the learnable skills and knowledges generalizable across several jobs within an occupational group. Given training in those skills and knowledges common to a variety of occupations, the student-graduate should have a greater flexibility in shifting with changes in industry. There is opportunity for increasing specialization, but it is built upon a broad base of more general competence within each vocational area.

A third outcome of the development effort will be a planned set of graded levels of specific education within each area, requiring a range of preparation times designated by jobs (or job clusters). The domain of jobs in an occupational group has been structured to reflect the progression of skills inherent in those jobs. Selection of jobs to represent the area reflects the levels involved so that there are clear points of demarcation where a student can attain certified competence up to the level commensurate with his individual abilities. This concept of multiple exits at points equivalent to the 10th, 11th, 12th, 13th, and 14th years of education and a specific usable skill for each student when he leaves full-time school is an integral part of Project ABLE.

Summary: Some readers have probably already recognized certain elements of the project as familiar ideas reported on elsewhere. For example, the job-task approach to the behavioral-performance analysis was used effectively in certain military training research programs. Forms of individualized instruction and the ungraded school have been used with some frequency at the elementary level, and also in secondary schools in Melbourne, Florida; Norridge, Illinois; Richmond, California and others. Specifying objectives is a long recommended procedure in curriculum development. New York City school officials recently made a point on the high school graduates with general diplomas as persons "all dressed up with no place to go." The Willis-Harrington report on education in Massachusetts included comments related to a range of content offerings at various ability levels, preparing persons to expect major job changes, and for curriculum materials which recognize individual differences. Project ABLE differs from other present vocational education development efforts in that it represents a multi-faceted approach by incorporating all of these concepts, principles, and recommendations in a single program to begin when the new school opens rather than making an operational application of one or two at a time. An ambitious undertaking, yes, but one which may well become a model for vocational-technical education.

Project ABLE Advisory Panel

Miss Ann Donovan, United States Office of Education
Dr. Hamden L. Forkner, New York City
Mr. Richard B. Ford, Carnegie Mellon University
Dr. Robert M. Gagné, University of California - Berkeley, (Chairman)
Mr. Norman C. Harris, University of Michigan
Dr. Joseph T. Nerden, North Carolina State College
Dr. Erwin R. Steinberg, Carnegie Mellon University

Education Policy Committee--Quincy System, Massachusetts

Dr. Lawrence Creeden, Superintendent of Schools
Maurice J. Daly, Ass't. Superintendent, Vocational-Technical Education
Joseph S. NiCastro, Project Coordinator

PROJECT ABLE STAFF

Key Personnel--American Institutes for Research

Mr. F. Coit Butler, Project Director, Pittsburgh Office
Mr. J. William Ullery, Project Director, Quincy Office
Mr. Glen Neifing, Associate Research Scientist

PROJECT ABLE

QUARTERLY TECHNICAL REPORTS

Morrison, E. J., Development and evaluation of an experimental curriculum for the new Quincy (Mass.) Vocational-Technical School. Pittsburgh: American Institutes for Research, June 1965.

Morrison, E. J., The problem of defining objectives. Pittsburgh: American Institutes for Research, September 1965.

Morrison,E. J., & Gagné, R. M., Curriculum implications of the study of objectives. Pittsburgh: American Institutes for Research, December 1965.

Morrison, E. J., & Hudak, V. M., A vocational guidance plan for junior high school. Pittsburgh: American Institutes for Research, March 1966.

Morrison, E. J., & Lecznar, W. B., The roles, characteristics, and development procedures for measures of individual achievement. Pittsburgh: American Institutes for Research, June 1966.

Morrison, E. J., & Lecznar, W. B., The development of learning units. Pittsburgh: American Institutes for Research, September 1966.

Morrison, E. J., & Lecznar, W. B., The sequencing of learning units. Pittsburgh: American Institutes for Research, December 1966.

Kowal, B., Hudak, V. M., & Butler, F. C., Problems relating to the development and implementation of a vocational curriculum. Pittsburgh: American Institutes for Research, March 1967. (not in print yet)

Hudak, V. M., & Butler, F. C., Development and tryout of a junior high school student vocational plan. Pittsburgh: American Institutes for Research, June 1967.

Butler, F. C., Seager, G. B., & Loch, C., The mathematics curriculum. Pittsburgh: American Institutes for Research, May 1968.

Crozier, P., & Butler, F. C., The electronics curriculum. Pittsburgh: American Institutes for Research, February 1969

AN EXPERIMENTAL PROGRAM

Submitted to the U. S. Commissioner of Education
Under the Provisions of Section 4(c) of
the Vocational Education Act of 1963

Project Title : DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL

Applicant :

Quincy Public Schools and
Coddington Street
Quincy, Massachusetts, 02169
Tel: (617) 471-0100

American Institutes for Research
410 Amberson Avenue
Pittsburgh, Pennsylvania, 15232
Tel: (412) 681-3000

Initiated by :

Maurice J. Daly
Asst.Supt. for Vocational-
Technical Education
Quincy Public Schools
Coddington Street
Quincy, Massachusetts, 02169
Tel: (617) 471-0100

Robert M. Gagné
Director of Research
American Institutes for Research
410 Amberson Avenue
Pittsburgh, Pennsylvania, 15232
Tel: (412) 681-3000

Principal Investigator :

Robert M. Gagné
American Institutes for Research

Submitted by :

Robert E. Pruitt
Superintendent
Quincy Public Schools

John C. Flanagan
President
American Institutes for Research

Federal Funds Requested : $623,550

Duration : Beginning 1 January 1965 Ending 31 December 1969
Total number of months required: 60 months

Date Transmitted: 6 November 1964

ABSTRACT

A. Submitted jointly by: Quincy Public Schools (Robert E. Pruitt, Superintendent; American Institutes for Research (John C. Flanagan, President)

B. Principal Investigator: Robert M. Gagné, Director of Research, American Institutes for Research

C. Title: DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL

D. Objectives: The principal goal of the project is to demonstrate increased effectiveness of instruction whose content is explicitly derived from analysis of desired behavior after graduation, and which in addition attempts to apply newly developed educational technology to the design, conduct, and evaluation of vocational education. Included in this new technology are methods of defining educational objectives, deriving topical content for courses, preparation of students in prerequisite knowledges and attitudes, individualizing instruction, measuring student achievement, and establishing a system for evaluating program results in terms of outcomes following graduation.

E. Procedure: The procedure begins with the collection of vocational information for representative jobs in eleven different vocational areas. Analysis will then be made of the performances required for job execution, resulting in descriptions of essential classes of performance which need to be learned. On the basis of this information, a panel of educational and vocational scholars will develop recommended objectives for a vocational curriculum which incorporates the goals of (1) vocational competence; (2) responsible citizenship; and (3) individual self-fulfillment. A curriculum will then be designed in topic form to provide for comprehensiveness and also flexibility of coverage, for each of the vocational areas. Guidance programs and prerequisite instruction to prepare junior high students will also be designed. Selection of instructional materials, methods, and aids, and design of materials, when required, will also be undertaken. An important step will be the development of performance measures tied to the objectives of instruction. Methods of instruction will be devised to make possible individualized student progression and selection of alternative programs, and teacher-training materials will be developed to accomplish inservice teacher education of Quincy School personnel. A plan will be developed for conducting program evaluation not only in terms of end-of-year examinations, but also in terms of continuing follow-up of outcomes after graduation.

F. Time Schedule: Beginning 1 January 1965
Ending 31 December 1969

G. Budget: Total cost $917,960
Total Federal Funds requested $623,550

1. PROBLEM

In April of 1963, the Division of Vocational Education of the Massachusetts Department of Education issued a report (1963) which recommended to the Quincy School Committee and Quincy administrators that a new vocational-technical school be established. Since that time, rapid progress has been made. The School Committee has approved preliminary plans and an architect has been engaged. Original concepts have been further defined (1964) to establish a basic division of the curriculum around families of related jobs. There is a particular concern with the education of the culturally disadvantaged who may manifest limited capabilities for learning. A particularly challenging part of the total problem relates to the overcoming of initial cultural and educational disadvantages which in their cumulative effects may show themselves in lowered student motivation and achievement.

Organizational planning is currently concerned with:

1. Achieving an appropriate balance of conceptual to manual skills in technician training.
2. Providing adequate opportunity for students to learn related and relatable skills and subject matter without sacrificing vocational learning.
3. Individualized scheduling.
4. Providing a differentiated curriculum on a continuum from practical to theoretical.
5. Programming with sufficient flexibility to permit vertical and horizontal transfers.
6. Making cooperative arrangements with business and industry that will provide valuable learning experiences which cannot be provided in the school.

Three factors conspire to make the Quincy vocational-technical school of great potential importance to vocational-technical education research:

1. The full brunt of modern technological change is upon American business and industry, but no parallel dynamic has yet burst upon public vocational education.

2. Major attention is currently upon vocational and technical education from a variety of disciplines and major institutions in our society. The breath of change is in the wind. The opportunity for innovation and breakthrough has never been better.

3. Educational technology has developed rapidly in the last few years and now represents a real potential resource if it can be appropriately tapped for the peculiar needs of vocational and technical education.

It is within this context that Quincy school administration has taken an experimental approach to vocational-technical education with the approval of state and local levels. It is within this context that the building of a new school will provide a unique opportunity for innovation. The curriculum for the new school is intended to extend from the 9th to the 14th grade, to include post-12th grade instruction in such vocational areas as electronics, metals, and computers.

The program and architecture of the new vocational-technical school in Quincy will be built around the concepts of job families. The school building is being designed by Caudill, Rowlett, and Scott, an outstanding firm of school architects who have demonstrated leadership in the development of schools with flexibility of function. Outstanding features of the design of the building are provisions for flexible placement of internal walls and for adequate above-ceiling spacing of utilities cabling. In general, it may be said that the possibilities of innovation and experimentation have been carefully incorporated into building design. It is here proposed that support be provided for the next logical step -- development and evaluation of a new curriculum based on an explicit derivation from the criterion performances desired of graduates.

2. DESCRIPTION

The American Institutes for Research and the Quincy Public Schools propose to collaborate in the execution of an experimental program involving the development and evaluation of a newly designed vocational curriculum, based upon modern educational technology, and to continue this cooperation during a five-year period.

The proposal which follows emphasizes the use of techniques for (1) developing vocational and technical course objectives based upon a behavioral analysis of the requirements of present and future jobs in the job families selected by the Quincy Public Schools; (2) selecting and designing instructional materials for topic objectives within these areas; (3) developing measures of performance to assess student progress; and (4) carrying out an evaluation of the program. In brief, the intent is to bring to bear some of the most promising new ideas in educational technology to the design, development, and tryout of a modern curriculum for the education of high school students who are oriented toward careers in which college bachelor's degrees are not involved.

A. Developing Objectives

The importance to the success of an educational venture of clearly defined objectives has been emphasized by various investigators of educational problems, including Tyler (1949, 1964), Dressel (1954), Bloom and his collaborators (1956), among others. At the level of college instruction, for example, teachers who worked at the process of specifying objectives are reported to have achieved great clarification in the content and method of course presentation, resulting in improved student achievement. When such objectives are made clear to the student, his interest and motivation are likely to increase. In addition, of course, well-defined objectives provide a basis for realistic appraisals of student achievement and progress. Examples of the relevance of objective definition to several varieties and levels of education are provided by Mager (1962). A striking example occurs in recently developed materials for elementary science developed by the Commission on Science Education, A.A.A.S. (1964).

In that field of specialized vocational education usually called military training, there have been many examples of the success of techniques for deriving educational objectives by analyses based upon careful descriptions of job requirements. Research personnel of the American Institutes for Research have been involved in such studies over a period of years, as indicated in the summary by Folley, Fairman, and Jones (1960). Another relevant account of the use of procedures to define military training requirements is given by Crawford (1962).

B. Selecting and Designing Instructional Materials

The modern trend in developing curricula and instructional materials seems definitely to be away from their determination by an individual author or teacher. The past decade has witnessed the completion of a remarkable number of newly designed courses in science, mathematics, social studies, and other fields, carried out by teams or committees of scholars (cf. Heath, 1964). It is somewhat rarely, however, that this method of curriculum development begins with clearly defined objectives (for an outstanding exception, see Commission on Science Education, 1964). An alternative method is to use the expert judgments of experienced educators and scholars in defining not only the ultimate objectives of some total entity like a "course," but also the subobjectives (in terms of student achievement) which contribute in a sequential fashion to the attainment of such objectives. The feasibility of such definition has been shown in the field of mathematics by Gagné and his collaborators (1962), by Kersh (1965), Hively (1963), and in other fields by Schutz, Baker, and Gerlach (1964), among others. Once the structure of a course or topic has been specified in this manner, it then should be possible to select instructional materials which are relevant to each subobjective, from a variety of sources, or to design them should they be found missing.

C. Developing Measures of Student Progress

Effective instruction in vocational education, as in other educational areas, is a function of the adequate measurement of educational achievement. Achievement measures need to be "scored" in behavioral terms so that they can be used to evaluate the degree to which objectives have been attained (Bloom, et al, 1956). The important conception that achievement scores need

to be referenced to criteria (that is, to objectives) rather than to norms occurs in the writings of Flanagan (1951), Ebel (1960), and Glaser and Klaus (1962), among others.

Data from Project TALENT (Flanagan, et al, 1964) provide baselines for both vocational and college-bound students in high school under currently used curricula and instructional procedures. Such data can serve as references for the evaluation of new varieties of instruction. Project TALENT tests also exemplify the attempt to build direct meaning about student performance into many of its scores, such as the comprehension of reading certain types of materials, the speed and accuracy of solving mathematics problems, the rate of acquiring specific items of new knowledge, which provide models for the development of appropriate instruments for measuring student progress.

D. Evaluation

Procedures for evaluation of educational outcomes on both immediate and followup bases have been provided by Project TALENT (Flanagan, et al, 1962). Modifications and refinements of these procedures are currently being employed in an A.I.R. study of the Process and Product of Vocational Education in the United States. In both these studies, students are followed up one, five, and ten years after graduation from high school to collect information concerning their employment, jobs, job satisfaction, salaries, participation in community affairs, hobbies, and other factors. It is then possible to relate these variables to those pertaining to student abilities and school characteristics. Based upon these techniques, the present proposal includes the design of a system of continuing followup of graduates of vocational education programs to determine educational outcomes following graduation.

E. Individual Differences

One of the most striking findings of Project TALENT has been the demonstration of the enormous range of individual differences within any single grade of a large comprehensive high school. In one such high school, for example, it was found that on a test of general information, the lowest 10% of the seniors were exceeded in score by 73% of the 9th graders. Similar findings obtain to those students who attend vocational high schools, insofar as the range of in-

dividual differences is concerned. Various methods are currently being used to try to overcome the difficulties in classroom-based instruction produced by such large differences in individual abilities. Perhaps the best known of these is "homogeneous grouping," which has sometimes been judged to be moderately successful, sometimes not. Obviously, though, the most direct type of solution would be one that instructed each individual in accordance with his own abilities and previous knowledge, at the same time taking into account his interests and career plans.

It is believed that these innovations, taken together, will lead to optimal effectiveness of the vocational education program if they are integrated by means of procedures which effect individualized instruction. The aim of this development is to give students individual responsibility for their own learning, oriented toward realistic and understandable objectives which can be incorporated as personal goals. The results of this kind of innovation are expected to be as spectacular as the somewhat similar efforts have been reported to be in other high schools. Of particular interest is the report of Rollins (1962) on the Middletown Project. Brown (1963), reporting his experience with the "nongraded high school" in Melbourne, Florida, makes the following statements (pp. 61-63):

> "In the nongraded school the intellectual pace of various students is more separate and unequal than in graded education. As the curriculum is expanded and becomes variegated, achievement becomes a hallmark of the school.
>
> "When we began to ungrade the high school at Melbourne, one of the earliest observations of the effects of change was a difference in the attitude of the student toward learning. Almost overnight, students began to take the initiative for their education away from the teachers. Not only did their attitude toward learning improve, but their behavior at school underwent an amazing transformation.
>
> "An analysis of the dropout situation at Melbourne lends additional credence to the value of gradeless education. Each year of nongrading has seen the number of dropouts decrease. While dropouts on the national level are continuing at 30 per cent, the figures at Melbourne last year had gone down to a mere 4 per cent."

3. OBJECTIVES

Project Goals

The principal goal of the project is to demonstrate increased effectiveness of instruction whose content is based upon explicit derivation from analysis of desired behavior after graduation. The subordinate goals which are embodied in the plan are as follows:

1. Development of educational objectives. The intent here is to identify the behaviors which are desired of the student when he has completed a particular course of instruction. These objectives will be stated in specific, operational terms. While emphasizing the vocational area of educational goals, they will include the development of individual attitudes toward work, habits of work, and standards of excellence. They will also give due consideration to the goals of self-fulfillment and good citizenship.

2. Derivation of curriculum requirements. Curriculum needs will be derived by an explicit and rigorous method, described in terms of topics within each "subject," and placed in an instructional sequence which takes prerequisite knowledges systematically into account. Particular attention will be paid to the overcoming of individual deficiencies which may represent the cumulative effects of cultural or educational deprivation.

3. Description of needs for prerequisite learning in junior high years. The elaboration of a new curriculum for the vocational-technical school will also make possible the specification of prerequisite knowledges to be acquired in junior high years of schooling, including the kinds of student preparation which might be gained in industrial arts and other basic areas of instruction. The aim of this description of preparatory instruction will be to make possible the development of broad exploratory programs in the junior high grades by the Quincy schools, to prepare students for productive educational and vocational careers.

4. Effecting changes in student viewpoints toward the new school. The new school, with its newly designed educational offerings, should become attractive to students of a variety of backgrounds and abilities. To insure that 9th grade students will make suitable choices, a special information and guidance program directed to this end will be undertaken. This involves the inservice education of junior high school guidance counselors, and the provision of materials and information for junior high students.

5. Individualizing instruction. A set of procedures will be devised which encourage the student to take responsibility for his own learning, and to pursue specific instructional objectives which he understands and accepts. This outcome in turn leads to the tailoring of instruction, within limits, to meet individual student needs.

6. Student evaluation. Appropriately derived topic objectives will lead directly to measures of student performance. It is desired here that all "units" of instruction have performance measures which are available to the student, to instructors, and to guidance counselors. The student evaluation file should be a clear history of learning achievement.

7. Program evaluation. Student evaluations will yield many of the basic data for program evaluation. A comprehensive program of evaluation will include other objective measures of immediate outcomes, as well as the foundations of techniques for the later collection of follow-up data on educational outcomes after graduation.

Vocational Education and Its Goals

The goals of the proposed project itself are conceived as part of a larger framework for education at the secondary level, pertaining particularly to those students who will not obtain a college bachelor's degree, and who comprise a large proportion (75-80%) of the school population. As the model of Figure 1 shows, such education is not conceived as being narrowly vocational, but rather as designed to produce effective and well-adjusted citizens for the modern world. Accordingly, the design of curricula and instructional procedures is intended to place suitable emphasis upon the need for generalizable knowledge having the aims of responsible citizenship, self-fulfillment as an individual, as well as flexibility of vocational choice in the face of changing occupational patterns.

As the figure indicates, the individual student approaches the choice of education at the secondary level influenced by factors in the community and his family, and by guidance obtained within the school system. An initial appraisal is made of his skills and knowledge for the purpose of guiding his tentative choice of a course of study. The school needs to be concerned not only with the individual's vocational goals but also those pertaining to his functioning as a citizen and as an individual concerned with fulfillment as a person. The instructional program of the school is devoted to establishing

VOCATIONAL EDUCATION AND ITS GOALS

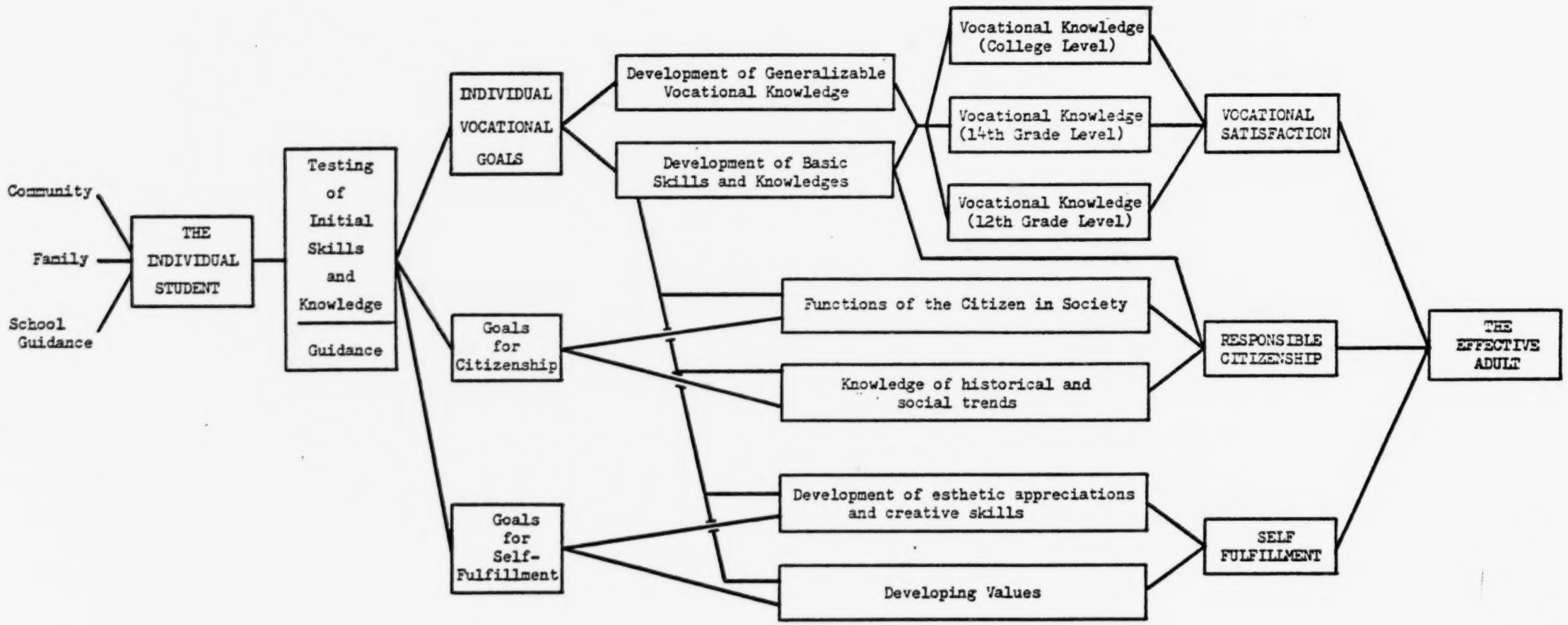

Figure 1. A model for modern vocational education

in the individual the skills, knowledges, and values that he needs to become an effective individual in society. It makes provision for those whose vocational education turns into a professional one at the college level, those who will achieve the competence of technicians, and those who will become skilled operatives in industrial or service occupations. In addition it makes provision for the achievement of educational objectives for the individual student, irrespective of cultural or educational limitations which may affect his level of intellectual functioning. Ultimately, the process is expected to prepare the individual as an effective adult, leading a satisfying and successful life in all three areas of vocation, responsible citizenship, and individual self-fulfillment.

Specific Outcomes

The findings and outcomes of the proposed program are expected to provide a demonstration of national significance regarding the improvement of the status and conduct of vocational education. More specifically, the expected outcomes may be outlined as follows:

1. The demonstration of applicability of newly developed educational technology to an important enterprise in vocational education. Included in this technology are methods of defining educational objectives, deriving course content, individualizing instruction, measuring student achievement, and evaluating program results.

2. Demonstration of the feasibility of highly flexible planning of vocational education for the individual student, incorporating goals of vocational competence, including positive attitudes toward work, effective work habits, and standards of performance. In addition, the goals of responsible citizenship and individual self-fulfillment will be incorporated and illustrated by a model providing a concrete description of such a system.

3. Increased amounts of student motivation and achievement, related in unusual ways to background and ability factors.

4. Development and application of techniques of providing instruction which takes full account of individual differences in ability, interest, and prior learning.

5. Development and application of new materials for student guidance in the junior high years, in preparing students to take advantage of the opportunities offered by sound vocational education compatible with their interests and abilities.

6. Demonstration of high amounts of vocational competence and versatility on the part of graduates of vocational and technical courses.

7. Design and establishment of a continuing system for evaluation of vocational education in the Quincy Public Schools in terms of procedures for assessing outcomes following graduation.

8. A set of reports and associated instructional materials which will account for the study and its findings, intended for the widespread dissemination of practical techniques, results, and conclusions.

4. ADMINISTRATION

It is proposed that the American Institutes for Research become the executive agent for the program, receiving and disbursing the funds required for its accomplishment.

Plans for the organization of the program are illustrated in Figure 2. As the figure indicates, four main elements in the organization of the program are planned: (1) a staff of research investigators experienced in educational research in the areas of vocational and technical education, provided by A.I.R.; (2) experienced educators of the Quincy Public Schools, some of whom will devote full time as members of the research team to plan and select instructional materials and methods, while others will serve as consultants in vocational education in particular fields; (3) a panel of university scholars who will meet periodically to review statements of educational objectives, and to give general guidance in the means of achieving project goals; and (4) supervisors of the Massachusetts Division of Vocational Education, and also personnel of the Division of Vocational and Technical Education, U. S. Office of Education, who will function as advisors in the planning of vocational education in various fields.

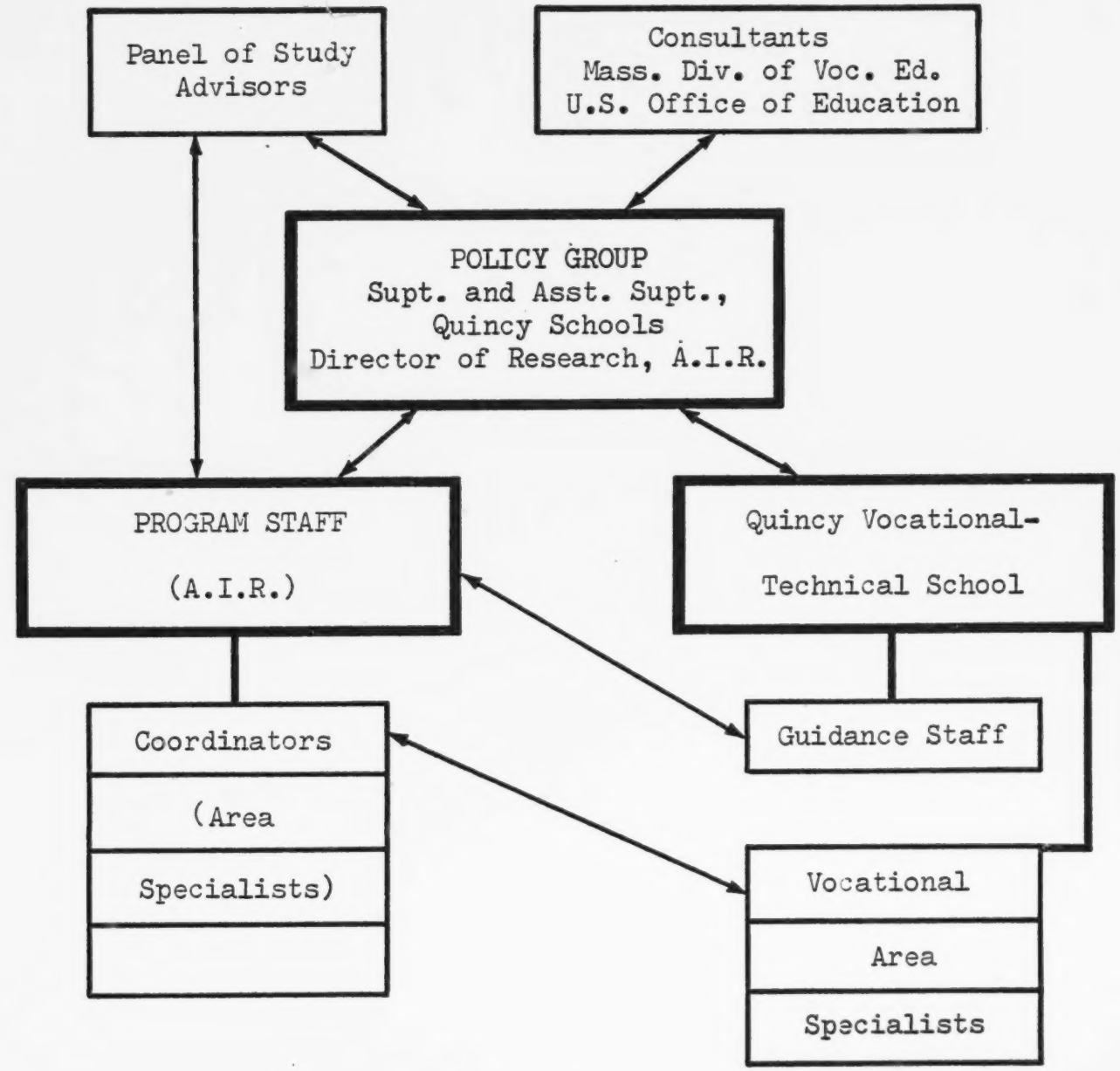

Figure 2. Organization of the Program and relation to other agencies.

1. A.I.R. Staff. The American Institutes for Research will provide a staff of research people who have had extensive experience in the fields of educational research, development of educational tests and measures, vocational education, technical training, learning and retention. An account of some of the organization's experience in these fields is described under a Section 8, Facilities.

A project director will be appointed together with two associates and other assistants as required. It is expected that these personnel will be experienced in the research fields of education and educational psychology. One or more members of the staff will be located in Quincy to maintain continuous coordination with the Superintendent and various members of his staff.

For the development of instructional materials, an experienced staff of educators will be needed to represent all of the vocational and subject-matter areas. It appears that half-time service with the project as employees of the project staff, can most readily be combined with half-time employment as teachers or supervisors in the Quincy school system. Since there are eleven vocational areas, as well as the basic subjects of mathematics, science, English, social studies, and the arts, a total of sixteen half-time people will ultimately be needed. These individuals will serve as coordinators of the efforts of curriculum development and instructional procedures design in their respective areas, and will also prepare materials for inservice teacher education. As their work for the project phases out, it is anticipated that they would become full-time members of the vocational-technical school staff.

2. Quincy Public Schools. The Superintendent of the Quincy Public Schools, and the Assistant Superintendent for Vocational-Technical Education will guide the project from a policy point of view (together with an A.I.R. representative), advised by the project's panel of advisors and consultants, and by the professional assistance of the A.I.R. staff. As stated above, coordinators of instructional development will be employed half-time as members of the school staff. As project employees, they will carry out frequent consultations with selected teachers in the various areas of vocational instruction for review of objectives, selection of relevant materials, and planning of instructional procedures.

3. Panel of educational scholars. A panel of seven scholars will be established to meet at intervals throughout each year of the project, for the purpose of reviewing instructional objectives and providing more general guidance to the project. While it is difficult to specify exactly the qualifications these people should have, it is believed they should possess a strong interest in vocational education, an understanding of the needs of the students who may not seek or attain a bachelor's degree, and representative knowledge of education in English, mathematics, social science, and science as basic or related subjects in the vocational curriculum.

4. Consultants in the State agency and Federal Office. Considerable assistance has been provided to the Quincy schools in the formulation of plans for a new school by supervisors of the staff of the Massachusetts Division of Vocational Education, as well as by its Director. It is contemplated that continued assistance will be sought from this Division in consultation on the design of curricula for the various areas of vocational education.

It is expected that periodic reviews of progress of the program will be made by the Division of Vocational and Technical Education, U. S. Office of Education. Open lines of communication will be maintained to representatives of this Office, and it is anticipated that the program will benefit by suggestions from this source. The competencies of the staff of this Office will be utilized to the greatest extent possible within the framework of the program's objectives.

5. PROCEDURES

a. General Design

The procedures to be followed are shown in outline form in Figure 3. In brief, they are as follows. Analysis will be made of the vocations chosen for emphasis in the Quincy program, to determine what kinds of knowledges and skills are now required and likely to be required in the future for these job families. With the aid of panels of consultants including vocational and other educational scholars, sets of objectives will be derived and stated in operational terms for each vocational area, to include those general objectives pertaining to self-fulfillment and responsible citizenship. Following this, curriculum topics will be delineated in proper sequence, to permit optimal flexibility of student programs. Instructional materials will be selected to meet each topic objective, and some may need to be newly developed. At the same time, performance measures will be developed in conformity with course and topic objectives. Finally, a plan will be devised to establish procedures for evaluation of the program, including the collection of follow-up data on graduates.

(1) Behavior analysis. This step will begin with the collection of job information for representative jobs within the job families chosen for emphasis in the Quincy program, namely:

a. Electro-electronics
b. Metals and machines
c. Power mechanics
d. General wood working
e. General piping
f. Foods preparation
g. Computer data processing
h. Health occupations
i. Graphic and commercial arts
j. Home economics
k. Business education

To some extent, detailed information on jobs within these areas is already available as a result of efforts on related projects; however, some new information will need to be collected. It may be emphasized that the details of job performance are not usually available in systematic published form, but must be collected and organized.

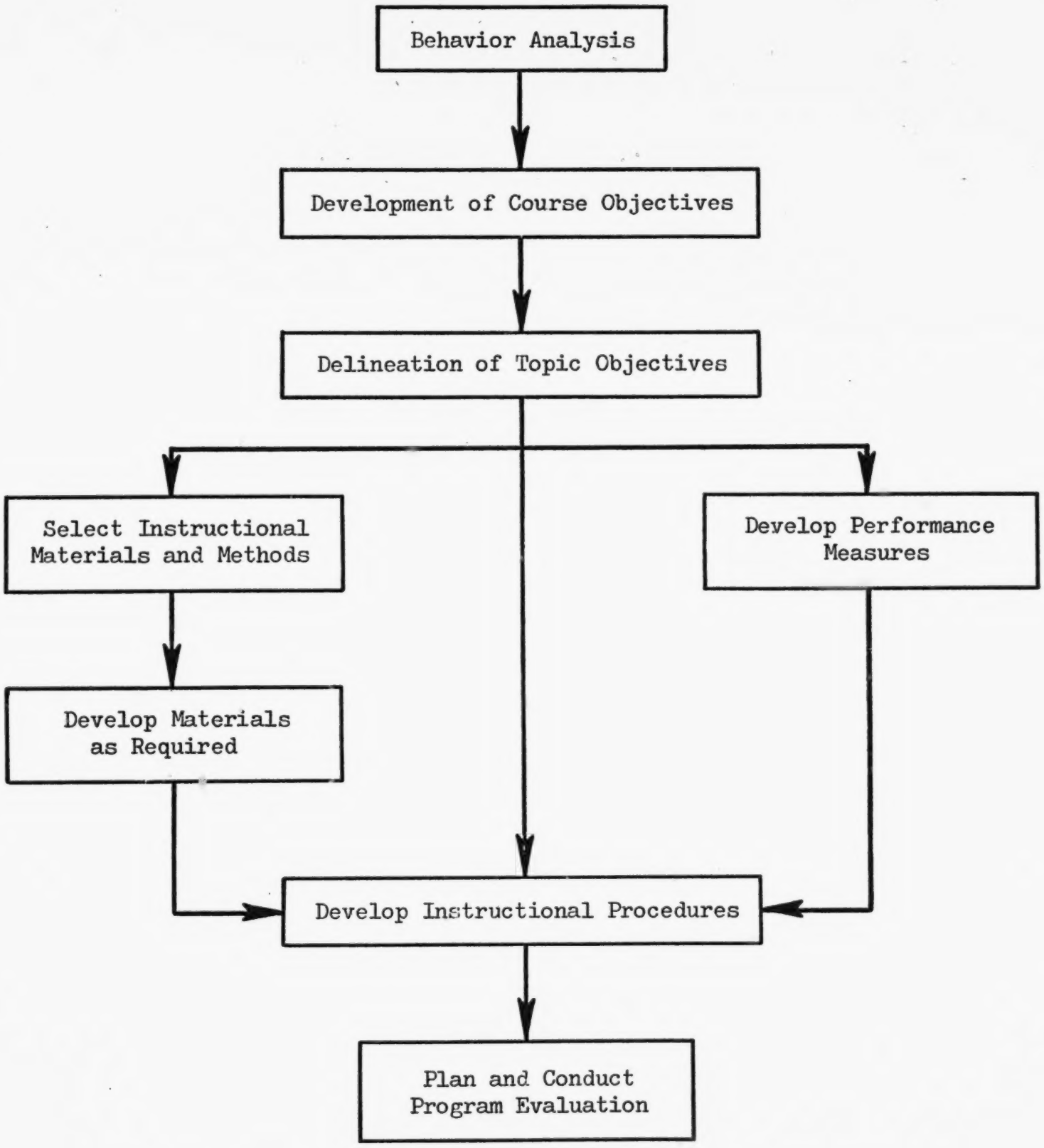

Figure 3. Overview of Steps in Curriculum Development and Evaluation

Beginning with job descriptions, analysis will be made of performances required for job execution, to distinguish the learnable skills and knowledges from (a) previously acquired basic skills (like hand printing) on the one hand, and from (b) highly specialized and specific job skills (like using a specialized instrument) on the other. Once identified, these learnable entities will be stated in objective language; for example, "Making rough sketches to show locations of electric outlets within floor layouts." This analysis will include relevant varieties of performances involving personal interaction, such as "Reassures patient concerning discomfort of procedures to be followed in hospital tests" (for a nurse). The results of this analysis will be a set of statements representing the performances required in jobs within each job family. It is expected that work habits and standards of performance will be included as findings of the analysis.

(2) Development of course objectives. From the statements of required performances will be derived a set of objectives for each course of study. Explicit rationales will be used to relate the learnable skills and knowledges to more general statements which represent the goals of instruction within each department. At this point, the objectives will be discussed and reviewed by a panel of vocational educators and educational scholars, in order to determine their appropriateness and comprehensiveness. The result of this effort should be a set of clearly understandable goals which can be used for universal communications of course objectives, to educators and public officials, to parents, and to students.

Additional consideration will be given by a panel of educational scholars to some of the broader goals of vocational education which need to be reflected in a core program of education. These include objectives which may be considered to reflect (a) responsible citizenship, and (b) individual self-fulfillment. These aspects of individual development should not be neglected within the orientation toward narrow vocational goals. Again, however, the attempt will be made to derive objectives which are identifiable and communicable to all concerned.

The areas of the curriculum which are considered to contribute broadly useful capabilities are those of (1) mathematics, (2) science, (3) English, (4) social studies, and (5) the arts. Specific objectives need to be determined for these subjects which will reflect the goal of establishing broadly applicable and generalizable competencies for the individual student, regardless of his occupational choice.

The description of objectives needs also to make adequate allowances for individual differences among students, and for flexibility of student progress within the educational system. Within given time limitations, for example, students who have elected the electro-electronic course of study should be permitted to progress as far as they can, and not be held back by rigid objectives applicable to particular grade levels. This implies that an ordered series of objectives may be needed, implying recognizably different degrees of progression for different students.

(3) Delineation of topic objectives. Once course objectives have been carefully defined, statements of topics and topical sequences within each course of study can be specified. In a sense, each of these statements may be considered a subordinate objective, consisting of a statement such as "Converts common proportions into decimal numbers." There are two primary reasons for the description of topic objectives. First, such a procedure is designed to insure comprehensiveness of coverage, and precision of coverage, of needed learnable skills and knowledges within the educational program. Second, it is designed to provide for flexibility of student programs of study, to allow for individual student needs and abilities.

Topic objectives will be reviewed by experienced teachers and vocational educators to insure that they adequately reflect the goals of instruction within each field.

(4) Guidance and information for junior-high students. Another aspect of preparation for the conduct of instruction in the new Quincy school is important for the success of the program, and needs to be initiated concurrently with curriculum planning. This is guidance and instruction for potential high school students, currently in junior-high, with the aim of establishing suitable appreciation of the educational opportunities to be offered by the new school. This effort should be a continuing one during the course of the experimental project, but needs to begin with specially prepared information and materials designed to bring about positive attitudes toward the new educational program. The following activities should be included:

(a) Providing inservice orientation and instruction for guidance counselors and teachers at the junior-high level, particularly grade 9.

(b) School and community information dissemination to emphasize novel approaches to vocational education and the opportunities provided by them.

(c) Preparation of materials for use of junior-high guidance counselors, providing information for students on the new program and its relation to employment opportunities.

(5) Selection of instructional materials, methods, and aids. Topic objectives provide a kind of detailed set of "course outlines" for which materials of instruction can be selected. The selection will require the active participation of teachers who have extensive knowledge of available materials in each field. The aim of such selection is to obtain the best possible instructional materials, including texts, workbooks, and audio-visual presentations, for the achievement of objectives in each topic of the course. The criteria used for selection should include the following:

(a) Each "unit" of instruction will make possible self-study on the part of the student in attaining specified objectives.

(b) Each topic's materials should fit in sequence with others that precede and follow them.

(c) It should be possible for the student to identify the objective of each topic and to recognize when he has mastered it.

The kinds of materials selected for each topic will probably vary considerably. Textbook or workbook chapters will undoubtedly be frequently chosen, and may require some revision to insure their integration into suitable sequences. Consideration will be given to available self-instructional programs, when these are appropriate to objectives. In addition, film strips and motion pictures will be selected to fill particular needs of course structure.

Shop exercises, of course, will also form a part of the materials being selected. In particular, the aim in such selection should be to insure an optimal arrangement for the practice of skills in the shop, based upon consideration of previously acquired skills and knowledges, either "basic" or "related."

(6) Development of required materials. In all probability, it will be found that detailed topic objectives cannot always be met by the use of existing materials in their exact form. Revision of these materials will be necessary to accomplish three main purposes:

(a) Provide transitional text relating each topic to foregoing prerequisite topics, and to more general objectives of the course.

(b) Design for self-study, so that each step in learning is contained within the materials themselves.

(c) Provide a means by which the student can determine his own attainment of the objective.

It is believed that materials for some of the topics will need to be newly designed, since it is not at all certain that existing texts or workbooks contain all of the material which will be found necessary on the basis of the analyses previously described. Such materials, too, will be designed to meet the criteria stated above.

Thorough consideration will be given during this stage of the project to the projected effectiveness of various audio-visual devices as means of accomplishing the desired instruction. Two general classes of device appear to deserve special attention, namely, inexpensive cartridge-loading film projectors designed for individual use, and simple cartridge loading tape recorders. Both of these appear to have promising potentialities for technical instruction involving media which present materials that are not printed language. More detailed specification of media requirements must, however, await the planning of instructional objectives. On the basis of such progress, it is likely that support will be sought for an additional project having the purpose of a systematic evaluation of relevant audio-visual media.

(7) Development of performance measures. On the basis of topic objectives, measures of performance will be designed to be administered to students as each topic is completed. Such measures of achievement will conform with acceptable test design procedures, but will also incorporate the following characteristics:

(a) Measures will emphasize performance, including the performance of basic skills, related skills, and shop skills. Verbal recognition or recitation of verbal sequences will be eliminated except when they are specifically a part of topic objectives.

(b) Test items will primarily be designed to assess whether the individual can or cannot accomplish the performances specified by topic objectives. In doing so, they will make the outcomes of assessment perfectly clear to both teacher and student.

(c) Other test items, carefully distinguished from those of (b) will be designed to assess the "breadth" of student knowledge (that is, its generalizability for the individual student) in relation to specific topic objectives. The purpose of such measurement, in contrast to (b), is to indicate the potential of the student in progressing to advanced parts of the course of study. (Some students need to "branch out," whereas others need to stay on a relatively narrow track.)

(d) Emphasis in testing is on the achievement of recognizable goals, rather than upon the differentiation of students into "good" or "bad." In a sense, the individual performance measure is designed to be viewed by the student as something he has to demonstrate he can do. It is not designed to demonstrate that one student is "smarter" than another. (Of course, the measures described under (c) may actually reflect such differences.)

(8) Development of instructional procedures. The utilization of instructional materials reflecting realistic topic objectives, together with their associated performance measures, can best be put to use within an educational framework which allows for great flexibility of student progression throughout a course of study. What this implies is a high degree of individualization of instruction, permitting each student, within established limits, to pursue the course of instruction which best fits his capabilities and interests. Individualized instruction has been accepted as a desirable goal of American education for a great many years. There is every reason why one should try at this juncture to come as close to achieving it as is humanly possible.

The important characteristics of a plan for individualizing instruction appear to be these:

(a) The student must be put in the position, and continually in the frame of mind, of accepting his own individual responsibility for learning. Knowledge is something he himself must acquire, not that which is "shoved down his throat."

(b) Defining objectives of instruction (both course and topic) in terms which are utterly plain to the student should go a long way toward making these the student's own goals.

(c) Similarly, it is made clear to the student that performance measures are designed to permit him to demonstrate his acquired competencies. This procedure is expected to contribute not a little to his motivation to learn.

(d) Measurement of performance is carried out at frequent intervals for the specific purpose of permitting teacher, student, and guidance counselor to know what progress has been made, as well as what directions of future effort should be planned for the individual student.

(e) Guidance takes on a new and added dimension within such a framework. It becomes a matter of relating student progress to his individual goals, as well as to more general course objectives, at <u>each step of the way</u>. It may be that this kind of "guidance" should be to a large extent a teacher function. Informing the student about his progress, about next things to be undertaken, relating each curricular choice to course goals and to vocational goals constitutes an important and essential part of what is meant by individualizing instruction.

(f) Planning individual alternatives within courses of instruction for the individual student becomes a major task for the teacher. Most teachers would like to do things this way; all that is needed to make it possible is determination and a suitable set of convenient instructional materials and tests. Student A, let us say, has taken a test on a particular topic and has not

been able to demonstrate competence. He must be advised to repeat the topic, perhaps using alternate materials. Student B has passed the test, indicating that he is ready to progress to the next topic. Student C has likewise passed the test, but his performance also indicates that he is able to generalize his knowledge widely. He may be expected to accomplish the next topic objective rapidly, and may then be led to choose additional materials which will enlarge the scope of his understanding and proficiency within his chosen area.

(9) Instruction for Quincy school personnel. The development of curricular and instructional plans will have still another outcome. This will be the preparation of materials to be used for the inservice education of Quincy teachers, guidance counselors, and other school personnel. The coordinators of development efforts in the various areas of the curriculum will have attained considerable experience and competence in the experimental program. They can develop the necessary materials, and also serve as leaders for summer workshops or seminars designed to prepare teachers of the new school for their functions and procedures in instruction. The conduct of such summer activities for teachers in the Quincy School System would in any case be planned as a normal part of preparation for the new school.

(10) Planning and conducting program evaluation. Immediate evaluation of the program will be provided by performance measures and records of student progress. It will doubtless be possible to show remarkable differences in individual rates of progress as a result of individualizing procedures. Furthermore, it may be expected that individual students of high innate abilities will be able to accomplish objectives extending beyond the limits of the school program itself. As for those whose abilities are more limited, it may be expected that steady progress toward the attainment of goals can be demonstrated, perhaps at somewhat slower rates.

Comprehensive examinations need to be planned and designed for "topic sequences," covering a larger range of knowledges and skills than are con-

tained in any single topic. Such examinations may roughly serve the purpose of "end of course" examinations, but they would not necessarily be administered on particular dates. In any case, the use of such measures will be designed to assess retention of job-related knowledges and job skills.

An additional aspect of evaluation will employ measures of school-associated and out-of-school activities as indicators of the effects of the program on attitudes, values, and interests of students. The applicability of such measures as participation in job-related activities, outside reading, types of recreation, and others, will be explored.

A plan will be developed for evaluation of the new educational program in terms of outcomes following graduation. One feature of such a plan should be the systematic recording and storing of indicators of student experience and performance during his years of high school and technical school attendance (if applicable). A second and most important feature is the establishment of techniques for following up the student at periodic intervals, so that his location is known. This will make possible the obtaining of information on employment, job success, career progression, and so on, at later intervals after graduation. Systematic information of this sort will constitute the basis for program evaluation in terms of its long term effects.

EIGHTH QUARTERLY TECHNICAL REPORT

Project No. 5-0009

Contract No. OE-5-85-019

DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL

Problems Relating to the Development and Implementation of a Vocational Curriculum

March 1967

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Bureau of Research

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Boyd Kowal
Vivian M. Hudak
F. Coit Butler

March 1967

The research reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

American Institutes for Research
Pittsburgh, Pennsylvania

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its eighth quarter of operation, 1 April through 30 June 1966. A brief overview of the project is presented first, followed by a report summary. The major portion of the report is a discussion of the development of performance measures to be used to assess students' achievement of the objectives of instruction.

OVERVIEW: Project ABLE

A Joint Research Project of: Public Schools of Quincy, Massachusetts and American Institutes for Research

Title: DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL

Objectives: The principal goal of the project is to demonstrate increased effectiveness of instruction whose content is explicitly derived from analysis of desired behavior after graduation, and which, in addition, attempts to apply newly developed educational technology to the design, conduct, and evaluation of vocational education. Included in this new technology are methods of defining educational objectives, deriving topical content for courses, preparation of students in prerequisite knowledges and attitudes, individualizing instruction, measuring student achievement, and establishing a system for evaluating program results in terms of outcomes following graduation.

Procedure: The procedure begins with the collection of vocational information for representative jobs in eleven different vocational areas. Analysis will then be made of the performances required for job execution, resulting in descriptions of essential classes of performance which need to be learned. On the basis of this information, a panel of educational and vocational scholars will develop recommended objectives for a vocational curriculum which incorporates the goals of (1) vocational competence; (2) responsible citizenship; and (3) individual self-fulfillment. A curriculum then will be designed in topic form to provide for comprehensiveness, and also for flexibility of coverage, for each of the vocational areas. Guidance programs and prerequisite instruction to prepare junior high students also will be designed. Selection of instructional materials, methods, and aids, and design of materials, when required, will also be undertaken. An important step will be the development of performance measures tied to the objectives of instruction. Methods of instruction will be devised to make possible individualized student progression and selection of alternative programs, and teacher-training materials will be developed to accomplish inservice teacher education of Quincy School Personnel. A plan will be developed for conducting program evaluation not only in terms of end-of-year examinations, but also in terms of continuing follow-up of outcomes after graduation.

Time Schedule: Begin 1 April 1965

Complete 31 March 1970

Present Contract to 30 September 1969

REPORT SUMMARY

This report describes the problems encountered while designing, developing, and implementing an experimental curriculum in a vocational-technical school. There are several dangers inherent in such a discussion because there is always a tendency to blame the inevitable inadequacies of the experimental program on the other fellow.

The failure to meet specific requirements of project development derives from a number of sources, some of which can be attributed to gaps or loopholes in the proposed methodology and some of which are the result of the unexpected. When each step is satisfied according to the plan, the resulting product usually has a greater chance of being implemented effectively in a live school setting. However, any design that fails to leave room for adjusting to the unforseen is lacking in itself. The realities of the implimentation phase almost always reveal significant gaps in the design and development phases--the largest gap usually being the failure to prepare an adequate design for implementation.

The initial enthusiasm associated with involvement in an experimental curriculum must be maintained through the tedious work of development and implementation. When any part of the process is separated from the whole, the loss of perspective which develops results in actions which often negate or impede the forward movement of the effort. The "old" ways are always near, and may be retrieved to fill any gap appearing in the new design. Although this may be necessary at times, such fixes tend to be retained rather than serving as a temporary filler until the innovative step is formalized and tested. Experience has demonstrated that this often becomes the case and it further diverts the outcomes from the original project goals. The description of the problem should be followed by suggestions for solving the problem. However, in most instances, the solution can be derived from the original specifications of the project methodology. Thus, there is a tendency to rewrite previous discussions which deal with specific aspects of the problem. In fact, the problems usually represent

deviations from the proposed scheme. When methodology is properly applied, the resulting product will probably meet the rigid criteria established within the framework of original project specification.

The problems discussed in the report are divided into four major sections:

I: General Curriculum Development
II: Development of Specific Learning Units
III: Implementation
IV: Tryout and Revision

In some cases, problems associated with one section reappear, or may be solved in later sections. There are recurrent problem trends which persist, however, regardless of attempts to control or eliminate them. Many of these are associated with personnel change occuring through the development phase. Particular sets of skills and attitudes are required to maintain consistent progress toward project goals. Training new personnel or re-training persons who have been on leave from the project for any duration limits the effectiveness of the products.

It is necessary to point out from the beginning that the responsibility for failure in any given dimension is a joint one. Inexact or incomplete coordination yields results which lack structural coherence and strength. Once the problems have been defined clearly, preventive courses of action can be specified and implemented.

It is hoped that the resulting report will specify problem dimensions with enough clarity to yield constructive resolutions for those attempting similar project efforts.

GENERAL CURRICULUM DEVELOPMENT

The procedures for curriculum development have been outlined and described in the Quarterly Technical Report series. Each has dealt with a particular step in this process; for example, the problem of defining objectives, the roles, characteristics and development procedures for measures of individual achievement, the development of learning units, the sequencing of learning units. In each report, alternative ways to complete each step are considered and one single approach is recommended.

A number of problems may be incurred as one moves from the theoretical level to the operational reality. An attempt is made to identify those factors at the source of each problem discussed.

Translating Theory into Products for Classroom Use

The logical derivation of learning unit materials follows a rather precise set of steps. Each step is a delineation of a preceding step, and in some cases, the successful development of a step is almost entirely dependent upon the successful completion of the preceding step or series of steps in the process.

Individuals may be more or less qualified to complete a given step; competence in one phase of development is no guarantee of success in completing subsequent phases. Application of the curriculum development procedures presumes an understanding of the theories and principles on which they are based. One persistent problem is that it is difficult if not impossible to provide a given model which accounts for all types of conditions and settings. Each vocational area and each academic area is defined by its own requirements and conditions. Behavioral objectives for one area may require very different cognitive processes and student abilities than another area. The kinds of behaviors which may be specified will depend to a large extent on the nature of the content and student capabilities selected as critical in the job hierarchy.

Some steps are much more difficult to realize than others. Initially, the definition of tasks is an objective procedure. In addition to the experience

in the trade and in teaching, and the expertise provided by the advisory board, there are a number of significant sources available to use as reference materials such as the Dictionary of Occupational Titles and the Occupational Outlook Handbook.

Objective tasks are more easily defined, particularly when the constraints imposed by the school (for example, type of training and equipment, size of facility, number of students) are specified. This applies to the statement of tasks, the job descriptions and job outlook. However, any number of course objectives may be derived from the required tasks. Alternative course objectives may be acceptable to fulfill the task requirements. Thus, a selection from among several viable alternatives becomes the prerogative of the coordinator writing the objectives. There is often the feeling that to state an objective in precise behavioral terms leads to restricted student activity or sets a behavior which may become outdated or obsolete in the very near future. Either of these feelings neglects to recall the basic principles for the project development, that is providing for flexibility and change by establishing a consistently derived and comprehensive framework.

Once the course objectives have been established, the derivation of topic objectives poses similar problems. In teasing out prerequisite behaviors for course objectives, many behaviors become more difficult to define; that is, they deal with actions frequently defined in education as "understanding," "appreciating," "having a grasp of." All of these can be translated into something which is observable to some degree. This is one of the most difficult parts of translating theory into a product. Arguments about the "intangibles" suggest that non-measurable things are in fact desirable outcomes of any particular course of study. Although this may be true in the sense that our powers of observing and measuring certain aspects of human behavior are limited, we must specify and deal with those within our power to assess as outcomes and assume that if these required behaviors are accomplished, the so-called intangibles will evolve as an out-growth of them

This problem occurs with varying intensity in the vocational or academic subject areas. In general, all areas experience difficulty in accomplishing the step, particularly when an attempt is made to specify something other than

an overt observable behavior. There is difficulty expressing in written form what a person knows or has experienced.

The degree to which objectives are clearly stated, effects the quality of the student evaluations designed to measure the student's proficiency in achieving stated objectives. When the behavioral objective is not clear, the items which measure the behavior are not clear and may not measure the desired behavior adequately.

Learning unit objectives are derived from topic objectives. Since these will be the outcome toward which all learning unit experiences are directed, they too must be stated in concise, behavioral terms which will preview or suggest the learning activities. The problems associated with stating these objectives and writing specific learning units are described in a later section.

Although the relationship between tasks, course objectives, and topic objectives is defined, an individual working on one step may isolate that part of the effort from the overall process. This tends to lessen the impact of a product which should evolve from preceding steps and reflect their logical continuity.

Required Coordination Between Area Specialist and Educational Research Personnel

The development of learning materials relies to a large extent on the comprehensive analysis just described. The extent and kind of coordination required by the effort is often difficult to predict prior to development. Some of the factors which influence this include: experience and extent of information possessed by vocational or academic area specialist, the amount of time which can be devoted to the task, the confidence of the person in the process which has been outlined and the willingness to cooperate with members of the project who advise on methodology and approach. If these characteristics can identified and evaluated prior to selecting individuals, a considerable amount of real progress can be made before the process begins. Working with subject matter experts may best be described as a case of individualized instruction or learning. Each person requires different amounts and kinds of technical assistance, motivation and reinforcement to progress.

Adequacy of Reference Materials Which Describe the Curriculum Procedures

Numerous publications exist which relate to procedures for curriculum development and evaluation. With few exceptions, they are directed to a rather limited audience, that is those who have been directly involved in the process or those who intend to pursue it on a fulltime basis. The faculty member who has become a member of the curriculum team often needs what might be described as a cookbook. This document describes the ingredients and the steps involved from beginning to end. These must be prepared as excerpts from project reports or as special documents which give examples, explanations and summaries as needed. It is necessary to test the adequacy of these directions and supplementary information provided. This is accomplished through direct feedback from the individuals involved in development, after they have demonstrated that the materials provide sufficient direction and information.

Identifying Necessary Qualifications of Personnel Involved in Project Development

Many different types of skills are required to complete all steps in the curriculum development. Comprehending the overall objectives and plans of the project, sharing information with other department members, conducting the research, writing objectives and creating materials--each requires distinct yet related skills. Persons who do well in one phase will not necessarily perform all other steps in a satisfactory manner.

In some cases, individuals are requested to develop materials for a vocational area range which is beyond their direct experience. It is not always feasible to release another person within a department who has the information necessary to fill the gap. This means that in some instances a coordinator must obtain the additional data in any way that he can, rather than in a systematic manner. Thus, the chain is weakened, and further development builds on a less than firm foundation.

There is a tendency for individual teachers to view the development effort in terms of their teaching-training experience. The most persistent carry-over seems to be the tendency to write for the teacher rather than for the student. Traditional lesson plans, teacher guides and course objectives have the teacher as the primary audience even though they are attempting to satisfy the individual needs of students. When the teacher attempts to describe what the student does, he usually ends up telling what the teacher does.

Writing in clear and concise terms is a problem. Some individuals have considerable difficulty in transcribing their experience into words which can be comprehended by students. There is a tendency to assume that a student will "know" certain things and thus, prerequisite behaviors are not always specified. Also, individuals who have learned and performed things in one way tend to repeat the procedure when they write the learning experiences. A given procedure may be appropriate, but it must be evaluated in terms of the behavioral objective, not in terms of an established precedent. Coordinators must be flexible in thinking of classroom situations. In order to have a student develop a stated capability, a teacher may have to do a number of different things rather than any single action such as a lecture or a demonstration. As a director of learning, the teacher must use many approaches to <u>assist</u> the student in the learning process.

Willingness to Participate in Change

Individuals within a given school system have a background of experiences and have brought a considerable degree of effort to bear on the problems of the teaching-learning situation. In the view of the instructor, what remains is the "reliable" result of personal research carried on through the years. Certain methods, materials, and approaches have been tried and rejected for one reason or another. Others have been tried and continued for other reasons. Some have been retained and modified to fit a given set of conditions. In general, the current operating procedures have been derived as a result of experiences in and out of the classroom.

When asked to completely re-think the problem of learning, there are varying degrees of resistance. Individuals may be quite satisfied with their products to date, either in terms of graduates or of a good classroom environment. Although the criteria may not be rigorously defined, they are sufficient to encourage the "status quo" at least for a while longer. Others have no qualms about beginning all over again, using the experiences they have gained. The enthusiasm, however, seems to continue only until the individual is asked to generate things which can "fit" into the already established pattern. When an individual must, for example, begin from a completely new starting point

or basis, or reformulate an approach, such that he is on "unfamiliar" grounds, there is a tendency to try and defend what has been, rather than use it to produce a different set of teaching-learning experiences.

Whenever an experiment is attempted, a certain risk is involved. There is always a chance that the new product will be only as good or worse than the existing one. The uncertainty associated with the situation is often detrimental to development and encourages a reiteration of "tried methods." These facts reinforce the notion that a firm conviction to project goals and methods must precede any development.

Establishing Priorities in a Complex School System

Even with unlimited resources and complete flexibility within a school system regarding faculty, students, and the scheduling of classes, the problems of curriculum development and tryout would exist. In most cases, a school must adopt new techniques within a structure that imposes restrictions and constraints. The introduction of new approaches often demands considerable shifting, rearrangement and reorganization of staff, and students and physical facilities. In the initial phase, the school continues to operate on its present basis, while attempting to release personnel for curriculum development activities and gear up for the preliminary tryout.

In the preliminary tryout phase, all individuals and classrooms may not be involved. Although the "new" is being introduced gradually over a period of years, the problems normally associated with maintaining an efficient, operating school system may be compounded. In effect, two systems are being conducted simultaneously. Even with intensive and comprehensive orientation to the new procedures and products, the day-to-day problems which administration, faculty, and students must face and solve still remain.

Thus, the establishment of priorities becomes a critical activity. Additional human resources and funds do not always provide the solution. It is difficult to foresee all contingencies. Individuals assigned to one activity may be called upon to meet an immediate need for which no one else is qualified. Another individual cannot always fill the gap created by an individual who has developed some expertise in developing curriculum materials--at least, not

without a great deal of training and practice. A qualified teacher may have to cover a vocational shop and demands of this type may easily draw curriculum developers away from their task at a moment's notice. There is a constant reordering of priorities each time a special situation develops, thus reducing the overall effectiveness of those involved in the experimental program development.

Communication among ABLE Staff, AIR, and School Personnel

Recognized as a critical ingredient in the success of a joint effort, adequate and comprehensive communication among project participants becomes imperative. It is not enough to maintain an "open door" policy which permits the free flow of information only when it is identified "as necessary or appropriate" by members of the development team. Frequent, direct contacts must be initiated and maintained to preserve the desired continuity, keep a current record of progress, both in quality and quantity, and provide almost immediate reinforcement and feedback. In this way, an up-to-date assessment of success and failure can be used to correct deficiences as soon as they occur. These assessments must, in addition, be concrete and direct. They must reassure participants of correct application of project methods and appropriate selection of content and media.

Some "less than tangible" types of information and communication are also required to boost morale and create a willingness to cooperate in the production of quality materials. Chief among these are frequent positive reinforcement and acknowledgment of expertise in a given content area.

Determination of Information Requirements for Project Personnel

Too much information can often be as detrimental to overall program development as not enough information. The "appropriate" level and type of information shared is different for different individuals involved in the program. Excess data or information can discourage individuals by its massive appearance. The task may appear too complex, with no end in sight, accentuating the risk involved if a mistake is made. Out of context, constructive argumentation or criticism can be misinterpreted as an accusation of individual incompetance. The whole-part method of learning information has

applicability here. The majority of staff members need only have an outline of the total program steps, followed by an intensive description of a particular step immediately preceding the work.

Allocating Time to Each Step of the Development

In order to assess the amount of time required to complete a given step of curriculum development, all the preceding factors must be taken into account. Assuming little or no experience on the part of curriculum developers, the most difficult phase and the one which consumes the greatest amount of time with only a few exceptions appears to be the derivation of course objectives. Since this is the hinge on which subsequent steps depend, the specification of objectives can legitimately demand additional time, providing they are clearly written in concise behavioral terms. If this step is completed adequately, there are fewer struggles as one begins to delineate sub-objectives and derive proficiency measures and learning experiences. This is not intended to underestimate the difficulty in developing each subsequent step; the products which flow from "good" course objectives, however, have a much greater chance of success than those which are extrapolated from less than specific behavioral objectives. The development of proficiency measures to evaluate objectives consumes the second greatest amount of time. Writing items and developing evaluation procedures requires a sophisticated application of measurement theory and demands instruction and assistance in constructing those which adequately measure the objectives. Since evaluation is used to assess learning objectives and student behavior, sufficient time must be allocated to this step, otherwise, it may be difficult to draw any conclusions about the success of the student or the system.

Although it is necessary to permit some flexibility in allocating time to each step of project development, it is imperative that certain deadlines be established for each unit of work. In order to progress, a point must be established beyond which no further revision can be made for a given step. A commitment is then made to the product as it appears for a given step. This prevents a deteriorating regression to former stages of development. Revisions will be necessary but, in most cases, can wait until the experience of tryout demonstrates the need for it. This is one more reason for creating good course objectives.

DEVELOPMENT OF SPECIFIC LEARNING UNITS

Identifying Prerequisite Behaviors for Tasks, Course Objectives, Topic Objectives, and Learning Unit Objectives

For efficient learning to take place, it is necessary to identify the appropriate behaviors and their prerequisites and to arrange them in a logical sequence. To accomplish this, tasks, course objectives, and topic objectives must be identified, analyzed, and organized in a hierarchy in which the certain behaviors are necessarily preceded by others. This continuum is applicable to one capability or a set of highly related capabilities and should not necessarily be followed for unrelated capabilities. For example, if it is necessary to differentiate between types of screwdrivers before using them, then the differentiation precedes use. It is unimportant, however, if it precedes a different, unrelated capability such as using a wrench.

One of the major difficulties in stating the behaviors associated with tasks is that the coordinators are unable to identify which tasks are appropriate to given jobs and the requirements of these tasks. There is a tendency to exaggerate the complexity of tasks or duties in occupations until it becomes difficult to differentiate between specific jobs on a given hierarchy.

The learning units are often sequenced to reflect textbook content rather than the required skill hierarchy. The result of this sequencing is not a new approach to teaching--it is breaking chapters of books into smaller elements.

Statement of Criteria for Behavioral Objectives

One of the elements of a complete behavioral objective is a statement of criteria which students must meet. This statement should be written in clear, precise terms so that the reader will have no difficulty in identifying the intent of the writer. In addition, it is written so that the behavior can be observed and evaluated objectively. Terms like "understand, appreciate, develop and appreciation of, etc." should be avoided.

There are a number of factors that make the writing of behavioral objectives clearly difficult. One is that in the past, behavorial objectives have not been written clearly. Objectives which state "to appreciate the relationship between X and Y" appear in numerous publications used by curriculum developers. Another is that there seems to be a reluctance to write in specific terms for the fear of omitting elements or exceptions which may pertain to a given capability. A third seems to be a desire to make the objective sound complex, pedantic, or highly literary. The thought appears to be that if the objective is simple and easy to understand it will diminish student motiviation to meet it. Finally, the criteria are stated in very nebulous terms as exemplified by objectives such as "student will demonstrate activity to accepted specifications."

Identifying Individual Learning Experiences

The learning experiences should reflect the various capabilities necessary to satisfy the learning unit objective. Their number and content may vary from unit to unit. In fact, it seems to be entirely appropriate that a given capability can, and should be attained through different kinds of learning experiences. For example, if certain knowledge is needed by a student to accomplish a given objective, this knowledge may be achieved through reading, viewing films or filmstrips, mockups, etc. The experiences should be sequenced in the same manner as the learning units themselves--that is, in a logical hierarchy. In addition, the experiences should be related to the unit objective and be meaningful to the student.

There are many factors which limit the variety of learning experiences. One of these is failure to explore the available alternate experiences. Generally, the experiences consist of those activities which are already mentioned in some textbook or manual. Another is the failure to transform a principle or theory into an activity. Still another, is the belief that for any learning to take place, the students must be assembled in a group and the teacher must lecture to explain the facets of a given concept or capability.

Performance-Type Activities

To provide the student with first-hand exposure to vocational capabilities, emphasis is placed on activity or performance-centered learning experiences.

These are augmented by experiences which provide the theoretical support and background. Performance oriented activities permit the student to utilize both cognitive and psychomotor processes in achieving the objectives of the learning unit. They also provide the instructor and the student with the opportunity to evaluate the attainment of vocational capabilities.

Non-performance activities such as reading or listening to a lecture, have their value, but these alone cannot provide the student with the capabilities which he will need in the working world. In addition, many students are at relatively low-reading and vocabulary levels, a situation which casts doubt on how much the student really learns through these methods. There is also a question if portions of theories, principles or other similar information are really needed by the student to achieve given capabilities at given skill levels or if they are needed at all. For example, is it necessary to teach the student to arrive at a square root of a number by the longhand method when square root tables are commonly available?

Determining how much theory and how much practice is to be included in a given learning unit is sometimes a difficult process. Very often, however, a clear statement of the learning unit objective will provide the answer. Frank and accurate requirements are also essential.

As with other segments of this effort, it appears that there are difficulties in deciding how much emphasis should be placed on theory and how much on practice or activity. There is a tendency to stress theory through reading and lecture. From this, the student must somehow demonstrate the capability to the satisfaction of the instructor. Activity is implied but not specified, and since the learning units are written for the student, there must be some method of translating the theory into action. How this is to be done is not clear, but it appears that it will result in the instructor telling the student or a group of students what to do each step of the way. If this is the result of developing learning units (and it can easily turn out that way), how does this differ from education before?

Development of Student-Oriented Materials

Learning units are developed for the student. It is he who must read and translate them into activity. The units must, therefore, be addressed to the

student in the language he understands. Activities of learning experience should be student rather than teacher-oriented; the student has to observe, perform, compare, associate, identify, etc., with the teacher assuming the role as an advisor or director.

The learning units, placing a greater responsibility for learning on the student, are also changing the role of the teacher. This role, as student director or advisor, requires that the teacher take a different approach to the learning process. He is involved in it, perhaps even more actively than before, but in a different manner. It is difficult to adapt to this change, since students have been taught (lectured) by teachers for many years. This difficulty is carried over into the development of learning units. There is a tendency to return to the traditional (teacher-oriented) approach, and the result is a learning unit giving directions to the teacher rather than to the student. In addition, there seems to be a somewhat strong reliance on lecture as a substitute for learning experiences. The argument here is that there is activity going on (i.e., lecturing by the teacher).

Perhaps one way to ensure that the units will be developed for the student is to write them in second-person-singular form. When this approach is used, the unit speaks directly to the student, telling what to do and in what sequence it should be done.

Relationship between Components of Learning Units

One of the most critical characteristics of a learning unit is the close relationship among its components. If this relationship does not exist or is tenuous, there is little hope of meeting the objective of any given learning unit.

The starting point is, of course, the learning unit objective. It determines the content and the parameters of the unit. The various components of the learning unit, particularly the learning experiences, should support and satisfy the unit objective. Upon completion of the activities prescribed by the learning experiences, the student should have in his repertoire, that capability stated in the objective.

The difficulty in developing units in which the components relate closely to each other is determined by the clarity of the learning unit objective. The clearer the objective, the easier it is to develop closely related components.

Another problem is the selection of appropriate reference materials and learning aids. This requires a consideration of a number of factors, such as the relevance of the information, the ability of the student to benefit from it, and its availability, cost, and ease of utilization. These must constantly be evaluated since the criteria for their selection may change from unit to unit.

The ultimate test of the relevance of learning unit components is the student's ability to demonstrate the capability stated in the objective. If he can satisfy this criterion, then much of the discussion about the components may be academic. There is another question that must be answered--that is, "how efficient is this method?" Is the objective being met at great expense to teacher and student time, is it costly, and is there another, more efficient method of reaching the goals stated in the objective? This problem should be resolved after the learning materials have been tried out and evaluated.

Relationship Between Learning Units and Student Evaluations

The student evaluation portion of the learning unit is designed to assess whether or not the student has achieved the goal or goals stated in the learning unit objective. It consists of a number of paper and pencil items (the number varies from unit to unit) and one or more performance measures which require the student to demonstrate the capability or capabilities specified in the learning unit objectives. Successful completion of these items permits the student to move to the next unit in the sequence or hierarchy. Unsuccessful performance requires a repeat of unit learning experiences or the use of alternative or supplementary means to meet the objective.

The validity of the evaluation depends heavily on the clarity and relatedness of the learning unit objective, learning experiences, references, and learning aids. Many of the problems encountered in developing the student evaluation portions of the learning units are, in fact, caused by the lack of

clarity and relatedness. When items are derived from references which are not related to the learning unit objective, then, although they may have face validity, it is likely that they are not measuring the behavior.

Another problem is determining how many items are needed to measure a particular behavior. For each learning unit a decision must be made on how many and what type items should be written. This decision is guided by the nature of the elements which make up the learning unit (objective, experiences, references, etc.). One certainty is that performance or activity items should be included in every student evaluation. These should require the student to act out the behaviors which are stated in the objectives. The performance of activities required by the objective should result in a valid assessment of student progress.

Supplementing the performance test are a number of pencil-and-paper items. These are developed to assess the knowledges associated with the behaviors and to identify students' weaknesses with respect to particular behaviors. The assessment of student capabilities should not rely on these items except in situations which require cognitive skills and simulate the behaviors adequately.

The types of paper and pencil items to be constructed are determined by the learning unit. It is difficult or inappropriate, at times, to rely solely on multiple choice items. The behaviors may be better simulated by measures which require the student to list sequences or match objects with objects, activities, rules, or symbols. Drawing symbols, sketches, or diagrams, and labeling symbols or objects are examples of paper-and-pencil items which simulate behavior very well.

In summary, there are many problems associated with developing an adequate assessment of any given behavior, but there are also many alternative solutions available to the item developer. The critical requirement of any evaluation is that the behaviors are assessed properly. This can be achieved if the behaviors are simulated well and the criteria specified.

IMPLEMENTATION

Organization of School System to Accommodate Different Learning Situations

A number of problems arise when a new curriculum does not entirely replace the old one. The school then has the problem of administering two entirely different approaches or systems of learning. The difficulty is further compounded when the two curricula are not compatible in terms of scheduling, learning materials, and teacher preparation.

The learning contexts in a vocational-technical school also present a number of problems which probably would not exist or be greatly reduced in a strictly academic situation. These consist of a number of items, such as equipment, space allocation, work assignments, etc. In addition, the physical presence of two groups, unrelated in terms of learning approach, seems to hinder the performance of both.

When a new curriculum which has little rigid control over student time and location is introduced, the students and the instructors appear to have some difficulty adjusting it. Different responsibilities for learning are placed on the student and on the instructors. Adjusting to this situation takes time, training, and a willingness on the part of the school administration, faculty, and student body.

Availability of Materials to Support Learning Experiences

Shortages of materials, learning aids, and other educational support seem to be an inherent problem in all educational systems. In a school system which introduces a new curriculum, the problem becomes more acute because the new situation requires more and different support (usually more expensive) than the old.

These materials must be identified specifically, and a method should be employed to make certain that they will meet their expectations. These materials are the means to an end; they support the learning unit only if the student requires their use. One of the problems, however, is that when the learning units rely heavily on reference materials, learning aids and other equipment which are not available to the students, the entire learning effort will be seriously hampered.

Large-Scale Introduction of Learning Units

When new learning materials are introduced into an educational system difficulty in implementing them is almost inevitable. This problem is increased when individualized materials are adopted by the system. First, the amount of materials is so great in number and bulk that it creates storage and distribution problems. Second, since the materials differ substantially from those used in previous years, both the instructors and students must be trained in their use. (The instructors must also be trained in the organization and application of these materials.) Third, is the problem of quantity reproduction of materials with limited equipment and small staff. (This problem is discussed in a later section.) Fourth, when two systems of learning are operating simultaneously in one school as mentioned previously, many difficulties arise. Of concern here is the control of materials in any department of the school. This control includes such factors as distribution of all learning materials, administration of evaluation measure, recording the results of the measures, and keeping an account of student progress. These factors require a great deal of paper work on the part of the instructors, and, coupled with evaluation forms of several kinds, the task is almost overwhelming.

There is a definite need to plan every detail and anticipate every contingency when introducing new learning materials into an educational system. Preparation of instructors in the administration of these materials and keeping records of student performance and characteristics of materials (appropriateness, student comprehension, validity, etc.) is essential. Many of the problems associated with large-scale introduction of new learning materials are yet to be identified, and these must be solved after all the pertinent data are collected and evaluated.

Reproduction of Developed and Revised Materials

Although quantity reproduction of learning materials seems to be a straightforward task, there are many problems associated with it. These range from the number and kind of equipment and personnel available, to the length and complexity of the materials themselves. Problems created by shortages of

2

personnel and materials and inadequacy of reproduction equipment are obvious. The difficulties in administering and coordinating quantity reproduction, however, are not as overt.

First, there must be a delineation of responsibilities in the administration of the entire reproduction effort. Such activities as purchasing materials, securing and maintaining equipment, hiring personnel, and transporting completed materials to their appropriate destinations are clearly administrative and clerical problems which should be handled by individuals trained and employed in this area.

Second, the technical editing and other technical support related to the learning materials should be the domain of the technical staff. This staff should not be expected to perform the duties of the administrators and clerks, as this hampers the efficiency of technical support which is so critical to the content of materials.

Third, the physical quality of the materials reproduced largely depends on the available staff and equipment. At this point, it appears that equipment is a more critical factor. Staff can be trained rather easily--after a few weeks they seem to perform their duties satisfactorily. Equipment, however, does not improve with use. While staff members can be trained to perform certain specialty tasks associated with quantity reproduction of learning materials, a ditto machine cannot be modified to perform as a four-color press.

Finally, there is the problem of flexibility of response. There are times when the demand on the staff for learning materials is overwhelming, and there are times when they are relatively small. A decision must be reached as to size of staff which is sufficient to cope with the contingencies which may arise at a given time. The content of the learning materials also determines the nature of the staff. Since many illustrations appear in the learning units, at least one staff member must be able to make the necessary illustrations. Those pictures or diagrams which are not within staff capabilities must be sent to a source which can reproduce them.

Staff Preparation for New Conditions of Learning

Preparation of instructors to operate effectively under new learning conditions is of utmost importance. The reasons for this are obvious. The

actual preparation itself requires an intensive effort on the part of the Project staff. The instructors must be provided with information concerning the philosophy of Project ABLE, its objectives, methodology, etc. The implementation and application of learning materials must be explained in detail so that there will be no question on the part of instructors as to how the materials are to be used in classrooms.

It is also important to involve the instructors directly in revising materials and suggesting the development of entirely new learning units. This involvement should facilitate teacher acceptance of Project ABLE materials and increase the commitment to implement the learning units. In addition, this approach has the potential of increasing the overall efficiency of the tryout and generating support for Project ABLE as a whole.

TRYOUT AND REVISION OF CURRICULUM MATERIALS

Monitoring the System

The long and tedious process of curriculum development brings about a product which provides specificity, clarity, comprehensiveness, and satisfaction of individual student needs. The product has been acquired by using a procedure which is at once exciting and exhausting. Although individuals may be reasonably proud of their efforts, the process does not stop here. The real "test" of the product is its tryout, evaluation, and revision phases.

It may be argued that tryout should rely on the expertise of the school staff. That is, the teachers are operating in a situation which should be more familiar to them. Even though new techniques and approaches are being utilized, the director of learning has the support of much of his previous teaching experience, particularly regarding course content. In some cases, however, the old methods may seriously interfere with the new learning materials and methods.

Preliminary implementation reveals a number of critical problems such as those identified in the previous section. The extent to which a system can operationally effect the new curriculum should be revealed during this phase. Procedures to alleviate the most difficult problems can be identified if the system is monitored adequately.

There is a tendency to feel that once the materials and classroom procedures are operational the work, per se,is done. In fact, there is a great deal of work involved in monitoring and evaluating the progress or lack of progress in all parts of the program. Many individuals contribute to this preliminary evaluation. Each has a responsibility to record the outcomes as they are experienced. To assist in this process, a set of evaluation forms has been devised and is designed to elicit the responses as soon as action occurs.

One set of forms requests written impressions and progress reports from students, teachers, counselors, and administrators. Although this demands additional effort, it is a good way to get immediate feedback on what is happening. There is general acquiescence regarding the method of gaining such

information, but there is a reluctance to do it. In addition to being time consuming, an individual may feel that stating a problem reflects an inadequacy in his efforts, and this reduces the impact of reporting hard-core problems. In wondering if their responses will affect their "grades," students may cover some of the most significant problems. Therefore, the impressions may be less than exact or recorded long after a unit has been completed. In either case, there can be a proliferation of the most serious problems.

The interview technique used for collecting data on program tryout also tends to elicit the desired response rather than real descriptions of what is occurring. If individual teachers and students answer "fine," the work of revision is reduced. There is no substitute for an honest appraisal of the program to anticipate and solve the basic problems, but obtaining it is not an easy task.

One way to insure more objective and complete recording is to instruct all staff on who should do what and when. Evaluation forms should then be collected individually from staff members to prevent delay or partial completion of evaluation.

Agreement on Content Validity

When the tryout evaluation has been completed and the responses summarized, one possible conclusion may be that several different approaches or types of content are suitable. Although this may be true, it is not always feasible to implement all approaches. A decision is required, and some agreement must be reached. This implies a departmental unity and staff cooperation. The evaluation of the "best" method or learning hardware must always be in terms of the original objectives. In some cases, these objectives must be modified or changed to satisfy critical needs of students.

Responsibility for revision must be designated and clearly specified to all participating staff members. Teachers and students will, in the final analysis, determine the effectiveness of any new program or approach. It is they who must make it work.

This report has touched upon the most obvious problems which face a group of persons attempting to develop and implement a new curriculum. It has not been possible to identify all problems or solutions. It should be viewed as signals designed to anticipate system difficulties. As such, it can serve as a comprehensive outline for a seminar or teacher-training institute. Structured properly, the most obvious and common problems could be identified, and steps could be initiated to resolve potential sources of difficulty.

From the delineation of problems, one significant fact emerges--the intent and procedures associated with the project must be delineated in concise terms which staff can understand and <u>accept</u>.